Skills Research Initiative
Initiative de recherche sur les compétences

Employer-Supported Training in Canada:
Policy-Research Key Knowledge Gaps and Issues

Zhengxi Lin (Human Resources Development Canada)
Jean-Francois Tremblay (Industry Canada, University of Ottawa)

Working Paper 2003 B-01

Human Resources Development Canada/Développement des ressources humaines du Canada
Industry Canada/Industrie Canada
Social Sciences and Humanities Research Council/Conseil de recherches en sciences humaines du Canada

Working Paper Series / Collection Documents de travail

Government of Canada Gouvernement du Canada

Canada

In the context of the federal government's innovation strategy, Human Resources Development Canada (HRDC), Industry Canada (IC) and the Social Sciences and Humanities Research Council Initiative on the New Economy (SSHRC-INE) are partnering to design and fund a multi-year skill-related research program–the HRDC-IC-SSHRC Skills Research Initiative (HISSRI). The research is grouped into four themes:

A. Labour Market and Skills Implications of Population Aging;
B. Employer-Supported Training;
C. Adjustments in Markets for Skilled Workers;
D. International Mobility of Skilled Workers.

Dans le cadre de la stratégie d'innovation du gouvernement fédéral, Développement des ressources humaines du Canada (DRHC), Industrie Canada (IC) et l'Initiative de la nouvelle économie du Conseil de recherches en sciences humaines (INE-CRSH) se sont associés pour concevoir et financer un programme pluriannuel de recherches sur les compétences, appelé Initiative de recherche sur les compétences de DRHC-IC-CRSH. Ce programme comprend quatre grands thèmes :

A. les incidences du vieillissement de la population sur le marché du travail et la main-d'oeuvre spécialisée;
B. la formation en entreprise;
C. l'adaptation du marché du travail aux travailleurs spécialisés;
D. la mobilité des travailleurs spécialisés dans le monde.

The HISSRI Working Paper Series provides a forum for the discussion of analytical issues related to the themes covered under the research partnership. Working Papers are circulated in the language in which they were written. The papers reflect the views of the authors and no responsibility for them should be attributed to HRDC, IC or the SSHRC. Comments on the papers are invited and may be sent directly to the authors.

La collection Documents de travail de l'Initiative de recherche servira de tribune où seront abordées plusieurs questions analytiques liées aux thèmes susmentionnés. Les documents de travail sont diffusés dans la langue dans laquelle ils ont été écrits. Les opinions qui y sont exprimées sont celles des auteurs et n'engagent pas DRHC, IC ou le CRSH. Le lecteur est prié de faire part de ses commentaires aux auteurs.

Skills Research Initiative
Initiative de recherche sur les compétences

Employer-Supported Training in Canada:
Policy-Research Key Knowledge Gaps and Issues

Zhengxi Lin (Human Resources Development Canada)
Jean-Francois Tremblay (Industry Canada, University of Ottawa)

Working Paper 2003 B-01

Human Resources Development Canada/Développement des ressources humaines du Canada
Industry Canada/Industrie Canada
Social Sciences and Humanities Research Council/Conseil de recherches en sciences humaines du Canada

To obtain copies of the documents published under the HRDC-IC-SSHRC Skills Research Initiative, please contact:

Publications Officer
Micro-Economic Policy and Analysis
Industry Canada
5th Floor, West Tower
235 Queen St.
Ottawa, Ontario K1A 0H5

Tel.: (613) 952-5704; Fax.: (613) 991-1261
E-mail: mepa-apme@ic.gc.ca

Pour obtenir des exemplaires des documents publiés dans le cadre de l'Initiative de recherche sur les compétences de DRHC-IC-CRSH, il suffit de s'adresser à :

Agent des publications
Analyse de la politique micro-économique
Industrie Canada
5e étage, tour Ouest
235, rue Queen
Ottawa (Ontario) K1A 0H5

Tèl. : (613) 952-5704; Fax. : (613) 991-1261
Courriel: mepa-apme@ic.gc.ca

104-06608/

Abstract

Firms' investment in training makes a substantial contribution to human capital formation. However, there are concerns that firms are under-investing in training because of various market failures and barriers that exists, providing a rationale for policy intervention. This paper explores some of the main knowledge gaps facing policy-makers in the area of employer-supported training with the objective of identifying key policy-related research avenues that could be pursued further. Our selective review focuses on research directions that could potentially improve our understanding of: i) the main covariates of training and the key factors behind Canada's relative performance in this area; ii) how firms' training decisions are affected by various factors including the structure of labour markets, innovation and technology adoption, organizational change, firm life-cycle patterns, the state of excess demand for skills in the labour market and policies; iii) the empirical importance of specific market failures related to training decisions and the form of appropriate policy responses.

Résumé

Les investissements des entreprises dans la formation contribuent de façon importante la formation du capital humain. Toutefois, on craint que les entreprises n'investissent pas suffisamment dans la formation cause de diverses déficiences du marché et de divers obstacles, d'o la justification d'une intervention sur le plan des politiques. Dans ce document, les auteurs se penchent sur les principales lacunes du savoir auxquelles se heurtent les décideurs dans le domaine de la formation en entreprise, afin de dégager les grandes possibilités de recherche sur les politiques qui pourraient faire l'objet de futurs travaux. Nous avons axé notre examen sélectif sur les orientations de la recherche qui pourraient nous aider mieux comprendre : i) les principales covariables de la formation et les principaux facteurs l'origine de la performance relative du Canada dans ce domaine; ii) la façon dont les décisions des entreprises en matire de formation sont influencées par divers facteurs, notamment la structure du marché du travail, l'innovation et l'adoption de la technologie, le changement organisationnel, le schéma du cycle de vie des entreprises, l'état excédentaire de la demande de compétences spécialisées sur le marché du travail et les politiques; iii) l'importance empirique de certaines déficiences du marché liées aux décisions en matire de formation et la forme que pourraient prendre des possibilités d'action appropriées.

1. Introduction

Investment in human capital is usually seen as critical to innovation and economic growth. Although large amounts of resources are devoted to initial education in Canada, the rapid pace of technological change increases the importance of supplementing initial education with job-related training. Because of the complementarity between technologies and skills, the adoption of new technologies in production typically requires substantial investments to upgrade the skills of workers. Therefore, moving towards a more innovative economy will likely require large human capital investment. Moreover, the demographic trends of the next few decades will also restrict the supply of skills through initial education, making the training of the existing workforce an important source of new skills.

Although various public policies could likely be instrumental in meeting this human capital challenge, policy-making in the area of employer-supported training is faced with important knowledge gaps. The goals of this paper are to review and discuss some of the issues involved and identify key research avenues that could potentially fill some of these gaps.

We focus primarily on firms' investment in training. Although both firms and workers may have strong incentives to support the costs of skill acquisition, employers appear to provide most of the training that adults receive during their working years. Apart from the fact that employees may face larger barriers than employers, particularly in financing the cost of training, firms may have stronger incentives to support training if they capture most of the benefits through higher productivity. Because of various labour market imperfections, training may lead to larger increases in the productivity of workers than increases in their wages, resulting in firms capturing a substantial part of the returns from skill investment. Firms may also have stronger incentives to support training if it complements some of their other activities, such as innovation and technology adoption. All in all, it seems natural to view employers as the ones making training decisions since they, rather than employees, most directly control the environment within firms.

Despite the potentially high returns from human capital investment, there are concerns that firms are under-investing in training because of various barriers that exist. For example, firms may face financing problems because of the typical failures that arise in the financing of human capital investment. Uncertain and insufficient returns from training investment, due to labour turnover for instance, can also weaken firms' incentives to train. And firms may simply have limited information about training opportunities, about the quality level of the training available and the ability of their employees to assimilate the training received.

The relationship between firm size and training suggests that smaller firms are particularly subject to training barriers. According to the 1999 Workplace and Employee Survey (WES), the participation rates of employees in employer-sponsored training (classroom and on-the-job) range from 45 percent and 53 percent in small and medium firms respectively to 62 percent and 67 percent in large and very large firms, respectively. The 1998 Adult Education and Training Survey (AETS) also shows that the likelihood of an employee participating in employer-sponsored formal training is about twice as high when employed by a firm of 100

employees or more than when employed by a firm of less than 100 employees, when probabilities are adjusted for industry, occupation, type of job, ownership, age and sex. There are several potential explanations to account for this pattern. For example, small firms may face more serious financing constraints, they may be unable to take advantage of economies of scale in training, they may have lower skill requirements because of a lower rate of technology adoption, they may train less because of risk aversion by managers, etc.

The fact that Canadian firms are not supporting training as much as some of their counterparts in foreign countries, also suggest that training barriers are particularly important in the Canadian context. From the International Adult Literacy Survey (1994-1998), the participation rate of core-age workers (25-54) in employer-sponsored training was 34 percent in Canada, compared to 43 percent and 56 percent in the United States and the United Kingdom, respectively. Such findings have led to concerns that the business sector in Canada may not be investing enough in the training of its workforce. Sub-optimal investment in training could eventually reduce firms' ability to adjust to the ageing population and undermine their productivity relative to that of firms in other countries.

Our objective for policy-making purposes is to determine whether levels of firms' investment in skills are sufficient. Two types of tests can be used to assess those investment levels. First, it may be useful to compare Canada's training performance with that of other developed countries, in particular the US.[1] Such an exercise may be indicative of whether Canadian firms are under-investing, although one needs to identify the appropriate benchmarks to judge Canada's training effort, and be aware of the numerous problems that arise when making this type of international comparison. The second type of test would focus on private versus social returns in order to determine whether the levels of firms' investment in skills are socially optimal, as defined by economic theory. Clearly, this second type of test is more difficult to conduct, but provides a more direct rationale for policy intervention.

Despite the important contribution of firms to human capital formation, we do not know much about the factors driving firms' decisions to invest in skills, on how those decisions might lead to cross-country differences in training activity, and whether these decisions are optimal from a social welfare perspective. Consequently, the broad knowledge gaps that we hope to address in this research program are the following. First, we need to clearly identify the main covariates of training and the proximate factors behind Canada's relative performance in this area. Such factors might include labour market institutions, the industrial structure, the intensity of R&D and policy factors, among others. Second, we hope to improve our understanding of firms' decisions to train, and in particular how these decisions are affected by the structure of labour markets, by innovation and the adoption of new technologies in production, by organizational change, by the life-cycle patterns of firms, by the state of excess demand for skills in the labour market and by policies. Finally, we need to improve our understanding of whether firm's training decisions are optimal from a social welfare perspective. Various market

[1] While comparisons with various developed countries should not be excluded, it may be more appropriate to benchmark Canada against the US, given the similarities in labour market structures, educational systems, institutions, and innovation systems. The training systems and labour market structures of most European economies are usually seen as quite different from those of Canada, which may make the comparisons of training performance somewhat inappropriate.

imperfections and externalities may generate a gap between private and social returns from training, leading profit maximizing firms to under-invest in training relative to the social optimum. If firms' training decisions are sub-optimal, there ought to be a role for policy intervention, in which case we also need to determine the objective and form of appropriate policies.

The next section looks at the level and distribution of training activity in Canada and how it compares internationally. Section 3 discusses the potential factors driving firms' decisions to train. Section 4 provides a discussion of market failures in the area of training and potential policy responses. Section 5 concludes. In each section, we briefly review the literature with the objective of identifying policy-related research directions that could be pursued further.

2. Training activities

This section focuses on the covariates of employer-supported training and the factors that may distinguish Canada's performance in this area, relative to that of other countries. New research in this area could allow for a more complete portray of how training activities vary with worker attributes, firm characteristics, labour market institutions and public policies, as well as provide a more comprehensive assessment of Canada's relative training investments, especially compared to the US.

2.1 The covariates of employer-supported training

What we know

There exists a considerable body of literature analyzing the covariates of employer-sponsored training. The majority of recent empirical work for Canada generally finds that the incidence of employer-sponsored training varies significantly with:

- Worker attributes, including gender, age, education and occupation.
- Firm characteristics such as size, industry, innovation activities, technology use, business strategies, geographic location.
- Various labour market institutions, practices and policies, including unionization, work organization, human resources management practices and training legislation.

This literature is subject to some limitations which raise some doubts about whether these findings provide a complete and accurate picture of training activity. In particular, most empirical work in this area focuses strictly on the incidence of formal classroom training. One exception is the recent work of Turcotte, Léonard and Montmarquette (2003), who examined the determinants of classroom training as well as on-the-job training, both in terms of incidence and intensity. Their study used data from the recently available Workplace and Employee Survey (WES), which provides linked employee-employer data, and therefore allows a richer analysis incorporating simultaneously a wide range of worker and firm characteristics. Some of their

results indeed suggest that going beyond the previous literature in these particular directions may provide a somewhat different picture of training activity.

Table 2.1 below presents WES data on the participation rates of employees in classroom and on-the-job training in Canada. Most of the characteristics included in the table, both those of workers and those of firms, are significantly correlated with participation in training. This suggests that empirical analysis of training based on employee surveys, and done at the worker level without incorporating employer characteristics other than the commonly available covariates such as size and industry, are likely to be biased. Such analysis cannot isolate the impact of the characteristics of firms in which trained employees work from the impact specific to the characteristics of workers. For example, some workers (e.g., professionals, better educated) are more likely to seek employment in firms that sponsor training. In such cases, if the analysis does not control for firm characteristics, findings will likely overstate the impact of worker characteristics on participation in training.

Table 2.1 also reveals that on-the-job training is an important source of workplace skills acquisition. The percentage of employees who participated in on-the-job training was 30% in 1999, compared to 37% for classroom training. Moreover, the ratio of participation rates in classroom and on-the-job training varies substantially according to different firm characteristics, such as size and industry. This may suggests, among other things, that the optimal mode of training is likely to differ across different types of firms, that particular groups of firms (e.g. small firms) may face larger barriers to formal training, and that different distribution of firm sizes and industrial composition across countries might lead to systematic differences in the level of reliance on informal training.

Table 2.1
Proportion of employees participating in training by selected characteristics: Canada, 1999

	Classroom (1)	On-the-job (2)	Ratio ((1)/(2))	Total[a]
Hours worked				
Less than 30 hours / week	25	31	0.83	47
Between 30 and 50 hours / week	39	30	1.30	56
50 hours / week or more	37	26	1.40	52
Occupation				
Manager	44	30	1.48	61
Professional	54	34	1.57	68
Technical / trades	35	27	1.29	51
Marketing / sales	21	28	0.75	43
Clerical / Administrative	32	34	0.94	55
Unskilled production worker	24	31	0.77	45
Use of computer at work				
Uses computer	45	35	1.30	64
Does not use computer	24	23	1.08	41
Covered by collective agreement				
Covered	41	31	1.34	58
Not covered	35	30	1.19	53
Tenure with employer				
Less than 1 year experience	26	36	0.72	55
1 to 4 years experience	35	34	1.03	57
5 to 9 years experience	38	27	1.42	52
10 to 19 years experience	40	26	1.54	55
20 years experience or more	38	27	1.43	53
Educational attainment				
No high school diploma	21	23	0.93	40
High school diploma	28	29	0.98	48
Certificate	36	26	1.37	51
College diploma	38	32	1.17	57
University degree	49	33	1.50	64
Gender				
Male	37	28	1.29	53
Female	37	31	1.18	56
Age				
15-24 years	24	39	0.61	53
25-34 years	40	31	1.29	58
35-44 years	40	31	1.27	57
45-54 years	38	28	1.37	53
55 years and +	31	19	1.64	42
Size of business location				
Fewer than 20 employees	26	24	1.09	44
Between 20 and 49 employees	31	30	1.03	51
Between 50 and 99 employees	37	39	0.97	59
100 or more employees	48	32	1.48	64

(continued)

Table 2.1 (concluded)
Proportion of employees participating in training by selected characteristics: Canada, 1999

	Classroom (1)	On-the-job (2)	Ratio ((1)/(2))	Total[a]
Industry				
Natural resources exploitation	43	30	1.43	62
Manufacturing	35	31	1.11	53
Construction	28	26	1.09	43
Transportation, storage, wholesale trade	39	29	1.37	55
Communication and other utilities	52	33	1.60	66
Retail trade and commercial services	23	28	0.81	45
Finance and insurance	59	43	1.35	75
Real estate, rental, leasing operations	30	21	1.44	44
Business services	44	28	1.55	59
Education and health services	45	31	1.48	61
Information and cultural industries	39	30	1.31	56
Region				
Atlantic	33	28	1.21	51
Quebec	36	18	2.01	47
Ontario	40	35	1.17	60
Prairies	37	35	1.04	59
British Columbia	30	32	0.92	51
Innovation				
Has innovated	40	32	1.23	58
Has not innovated	32	26	1.24	48
Technology				
Has introduced a technology / software	40	33	1.23	59
Has not introduced a technology / software	34	28	1.24	51
Total	**37**	**30**	**1.23**	**55**

a Employers may provide and employees take both classroom and on-the-job training.
Source: WES per Turcotte, Léonard and Montmarquette (2003).

Knowledge gaps

In order to have a more complete and accurate picture of the determinants of training, additional research along the following lines would likely be useful.

On-the-job training

Learning more about the determinants of on-the-job training and exploring the extent to which the distribution of investments in on-the-job training across different groups of workers and firms differs from the distribution of classroom training would be useful. If the level of reliance on informal training varies substantially across groups of firms and workers, restricting the analysis to classroom training is not likely to produce an accurate picture of the determinants of overall training investment. Moreover, such an analysis may be useful for policy purposes if it provides some indication about the presence of barriers to formal training faced by particular

types of firms and workers. It may also improve our understanding of a number of related issues, for example: Is on-the-job training a more effective mode of developing skills in smaller firms and for certain groups of workers? Are firms using on-the-job training as complement or substitute to classroom training? Which factors determine firms' choices between classroom and on-the-job training? Are the fixed costs of classroom training leading smaller firms to opt for on-the-job training?

Linked worker-firm level analysis

To expand our knowledge about the determinants of training, it seems critical to take advantage of the available linked employee-employer data. Apart from allowing more accurate and unbiased estimates of the effect of particular firm and worker characteristics, this type of analysis could provide some indication about how the attributes of employees and firms' activities jointly affect training decisions. As well, such data sets may allow to examine more comprehensively the impact of specific factors related to the knowledge-based economy, given the complementarities between worker skills and innovation, technology use, work organization, human resources management practices, etc.

Intensity of training

In addition to the incidence of training, it seems important to understand better the determinants of the intensity of training, perhaps measured by the proportion of a firm's employees that received training[2], by the average number of training hours that workers receive, or by the duration of training periods. Given that there may be trade-offs between the incidence and the intensity of training, the distribution of training hours across different groups of firms and workers may be quite different from the distribution of participation. Are some types of firms choosing to concentrate training resources on a few employees rather than spreading them over larger groups of workers? Are the determinants of short-duration training different from those of long-duration training? How is firm size affecting the proportion of employees trained and the duration of the training offered?

2.2 Canadian employer-supported training in an international context

What we know

Table 2.2 below reports International Adult Literacy Survey (IALS) data on participation rates in employer-sponsored training across selected countries. The participation rate of Canadian employees aged 16-65 is 27 % compared to 37 % in the US. Participation rates are also much higher in the UK and New Zealand, but quite lower in Ireland and Belgium. IALS data also shows that Canadian employees receive less hours of employer-sponsored training than their

[2] WES data reveals that, within firms that sponsored training, 63% of employees received classroom training and 66% received on-the-job training (Turcotte, Léonard and Montmarquette, 2003).

US counterparts. On average, employees in Canada receive 21 hours of training per year, in comparison to 25 hours in the US.

Table 2.2
Participation rates in job-related employer-sponsored training across selected countries

	Participation Rate
United Kingdom	50
New Zealand	40
United States	37
Netherlands	29
Canada	27
Ireland	16
Belgium	16

Source: International Adult Literary Survey (IALS), 1994-1996. The data refer to job-related training that employers provided to or partially paid for employees aged 16-65. Data refer to 1994 for Canada, Ireland, the Netherlands, and the United States; 1996 for Belgium, New Zealand, and the United Kingdom.

Canada-US comparisons of aggregate participation rates and hours of training hide substantial differences for particular groups of firms and workers. For example, Table 2.3 presents participation rates and average hours of training across industries. The large variations observed across industries suggest that differences in the industrial composition are likely to have a significant impact on the overall incidence and intensity of training observed across the two countries. However, within industries, there are also large differences between Canada and the U.S., which implies that Canada's relative performance cannot be explained by industrial composition alone.

Table 2.3
Participation rates and hours of training in employer-sponsored training across industry

	Participation Rate		Annual Average Hours per Employee	
	Canada	U.S.	Canada	U.S.
Agriculture, hunting, forestry and fishing	10.4	6.4	2.3	7.7
Mining and quarrying	42.4	56.8	96.8	50.6
Manufacturing	18.4	28.2	19.3	19.2
Electricity, gas and water	29.8	38.3	24.7	20.3
Construction	19.5	24.4	9.4	62.0
Wholesale and retail trade	13.6	23.4	12.4	16.2
Transport, storage and communications	45.5	42.8	30.2	31.8
Financing, insurance, real est. and bus. services	46.4	43.1	34.2	26.2
Community, social and personal services	31.1	45.4	21.3	27.0

Source: International Adult Literary Survey (IALS), 1994. The data refer to job-related training that employers provided to or partially paid for employees aged 16-65.

Table 2.4 reports participation rates and hours of training according to the education attainment of workers. In both countries, the incidence and intensity of training tend to increase with the level of education. Canadian workers with intermediate levels of education (completed secondary and completed non-university post secondary) receive more hours of training than their U.S. counterparts, even though their participation rates are lower. In contrast, participation rates and average hours of training among university graduates are much lower in Canada than in the U.S.

Table 2.4
Participation rates and hours of training in employer-sponsored training by educational attainment

	Participation Rate		Annual Average Hours per Employee	
	Canada	U.S.	Canada	U.S.
Did not complete primary	3.6	-	0.6	-
Completed primary	9.8	16.6	4.2	19.3
Some secondary	11.8	8.8	11.1	3.3
Completed secondary	20.5	26.3	17.5	16.3
Completed non-university post secondary	40.3	45.4	33.8	28.8
Completed university	42.1	55.0	28.2	41.7

Source: International Adult Literary Survey (IALS), 1994. The data refer to job-related training that employers provided to or partially paid for employees aged 16-65.

Studies using data from national surveys more or less confirm the above picture. For example, the 1999 OECD Employment Outlook uses various data collected by member countries to analyze the level and distribution of adult worker training. The results show that Canada ranks in the middle of the pack both in training participation rates and volumes, but slightly behind the United States.

Most recent international comparisons are performed using either national surveys or so-called "harmonized" data.[3] In both cases, there are several problems. These include differences in the extent to which the survey questionnaire and data collection process are harmonized among the participating countries. These data also differ in the precise definitions of training activity, the population sampled and the countries and years for which data are collected (see OECD (1999) on detailed characteristics and discussions of differences among these data).

Knowledge Gaps

Canada differs a great deal from other countries in several factors that are commonly found to be significantly associated with employer-supported training. Such factors include industrial composition, initial education, labour market conditions, firm characteristics (e.g., size structure), institutional arrangements (e.g. unionization) and public policies.

[3] The four OECD harmonized data sets are the International Adult Literacy Survey (IALS), the EUROSTAT's European Labour Force Survey (ELFS), the OECD/INES (Indicators of Education Systems), and the EUROSTAT's Continuing Vocational Training Survey (CVTS).

Despite the problems mentioned above, new research could take advantage of existing national surveys on training, which generally provide more detailed information than international surveys, and determine the extent to which these factors, among others, can explain international differences in employer-sponsored training. Examples of existing national surveys include the WES for Canada, the Workplace Employment Relations Survey (WERS) for the UK, and the Workplace Industrial Relations Survey (WIRS) for Australia.

3. Firms' decisions to train

In this section, we examine the incentives of employers to support training and review some of the associated empirical evidence. We begin with a discussion of the costs and returns from training to firms and workers, in terms of productivity gains and increased wages. In particular, we look at how imperfections in the labour market might affect the incentives of employers to support the cost of training. We then examine the complementarities of firms' training decisions with technological change and organizational change, as well as how training activities might vary over the firm's life-cycle and be affected by the state of excess demand in the labour market and policies.

3.1 The costs and returns from training in imperfect labour markets

What we know

According to the human capital theory of Becker (1964), firms invest only in the specific skills of their workers and earn all the returns in terms of higher productivity, while all the cost of investment in general skills are supported by employees who earn the benefits in the form of higher wages. Since the alternative wage that workers could receive at competing firms is determined by their level of general skills, firms cannot recoup the costs of general training because they cannot pay trained workers below their productivity level under perfect competition in the labour market. Hence, in the absence of labour market imperfections, only workers have incentives to invest in general training.

More recent models have emphasized how the presence of imperfections in the labour market generates incentives for firms to invest in the general skills of their employees. For example, labour market frictions arising from matching and searching costs create a potential surplus that employees and employers can jointly appropriate if they avoid destroying their match. This surplus increases with the level of skills of the workers, and since it is divided between the firm and the employee, firms can increase their profits by investing in training (Acemoglu, 1997; Acemoglu and Pischke, 1999a). Asymmetric information between the current employer and potential employers can also create incentives for firms to invest in general training. If outside firms cannot perfectly observe the quantity and the content of the training received, they will not be willing to offer wages that compensate for the skills acquired (Katz and Ziderman, 1990). Thus, the wage increase of a trained worker at the current employer will be less than the productivity gain that results from training. In this case, the wage structure is said to be compressed in the sense that workers' return from skill acquisition is less than it would have

been in a competitive labour market, and the gap between productivity and the wage rate increases with the level of skills (Acemoglu and Pischke, 1999a). Similarly, the superior information of current employers about workers' ability can provide some market power to the current employer and generate incentives for firm-supported training. Since laid-off workers tend to have low ability, high ability and well trained workers cannot leave their current job and credibly signal their ability (Acemoglu and Pischke, 1998). In this case, adverse selection generates wage compression.[4]

Hence, the presence of imperfections in the labour market can generate conclusions that are in sharp contrast with those of Becker's perfect labour market model. At the empirical level however, it is difficult to distinguish between general and specific training, which makes testing these predictions fairly difficult. Purely firm-specific skills are rare (Neal, 1995), and most training seems to involve both general and specific components. Nonetheless, there is some evidence suggesting that firms invest in general training.

Loewenstein and Spletzer (1998) find that employers pay the explicit cost of training taken at the workplace and of general training taken outside the workplace, such as seminars and training programs, provided in schools or technical institute, and correspondence courses. Even though the cost of general training could be paid by workers indirectly in the form of lower initial wages, there is little empirical evidence to suggest that employees receive lower wages in order to co-finance training activities (Barron, Black and Lowenstein, 1989; Lynch, 1992; Barron, Berger and Black, 1999; Loewenstein and Spletzer, 1998; Booth and Bryan, 2002).[5]

Given that employers appear to pay a substantial part of the costs of training, even if it is general in nature, we should also expect employers to receive a substantial part of the benefits as well. Indeed, some empirical evidence does suggest that the effect of training on productivity growth is at least five times as large as the effect on the growth of wages (Barron, Black and Loewenstein, 1989; Barron, Berger and Black, 1999; Bishop, 1991). Moreover, as Loewenstein and Spletzer (1998) find in wage regressions, general training sponsored by previous employers leads to higher increases in wages than training sponsored by the current employer, which suggest that training firms do have some oligopsony power and capture a substantial part of the benefits of their investment in general training.

Knowledge gaps

The fact that most employer-supported training seems to be quite general and that employees may not bear much of the cost, either directly or indirectly through lower wages, strongly suggests that training decisions are likely to be better understood in the context of non-competitive labour markets. Therefore, an important area for future research would be to examine how the labour market structure and institutions affect employer support for training

[4] Other mechanisms have been shown to generate wage compression and incentives for firms to train. For example, firm investment in skills that are partly transferable across firms can lead to wage compression (Stevens, 1994). Labour market institutions, such as minimum wages and unions, can also compress the wage structure directly and provide incentives for firms to provide general training (Acemoglu and Pischke, 1999b).

[5] There is some limited contradictory evidence (e.g. Veum, 1995). There is also some evidence that workers accept to be trained outside working hours, which does represent a cost borne by workers (Autor, 2001).

and to what extent is Canada's relative performance in the area of training the result of more general labour market phenomena[6]. For example, to what extent are wage structures compressed in Canadian labour markets, relative to other developed countries, and what role does this play in explaining the training performance of Canadian firms? What labour market imperfections, if any, appear to affect significantly Canada's aggregate wage structure, relative to other countries, in particular the US? Do institutional factors, such as unions and minimum wage legislation, affect the employment relationship in Canada, the level of wage compression, and ultimately the incentives of firms to provide training?

3.2 Training and technological change

What we know

The complementarity between innovation/technology use and employer-supported training is well documented for Canadian firms. Baldwin and Johnson (1996) report that a higher proportion of employees in innovative firms receive employer support for both formal and informal training. Employer-supported classroom and on-the-job training is found to be positively related to innovation in products, services and processes, and with the implementation of new technologies or software (Turcotte, Léonard and Montmarquette, 2003). Rao, Tang and Wang (2002) found innovation to be positively associated with the use of government programs for training, and Wannell and Ali (2002) report that workers in firms that introduced a new technology are more likely to receive training.

One potential explanation for this relationship is that training is used by firms to fulfil the skill requirements arising from the use of new technologies. Empirical evidence does show that innovating firms face increased skill requirements (Baldwin and Da Pont, 1996; Baldwin, Gellatly, Johnson and Peters, 1998, Baldwin and Johnson, 1996). Since there may be coordination problems between firms' decisions to adopt new technologies and the decisions of workers to acquire the complementary skills, innovating employers may choose to provide training even if employees capture part of the benefits. Therefore, in the presence of complementarities between technology and skills (see Gera et al (2002) at the industry level), the adoption of new technologies and training investment may be better viewed as a joint decision taken by firms. In this case, training should be viewed as a cost of technology adoption which would presumably slow down the diffusion of innovations, particularly when adopting new technologies requires firm-specific skills that cannot be acquired by hiring new workers.

In the area of knowledge creation, firms may actually use training as an innovation strategy. In many service industries for example, the product required by clients is the knowledge of specialists, and the quality of the product is directly related to the ability of firms to develop their knowledge base. In contrast to manufacturing industries, where the innovation strategy typically relies on R&D and technology embodied in physical capital, the innovation system of

[6] See Acemoglu and Pischke (1999a) for a discussion of how different labour market institutions in the US and Germany might explain differences in training practices, and Brunello (2002) for empirical evidence on the relationship between training and wage compression in EU countries.

firms producing services depends critically on human capital formation (Baldwin and Johnson, 1996; Conseil de la science et de la technologie, 2003).

Knowledge gaps

For policy purposes, the complementarity between technological change and employer support for training needs to be better understood. For instance, although there is limited evidence suggesting that labour-related problems (e.g. skill shortages) act as barriers to the adoption of advanced technologies (Baldwin, Sabourin and Rafiquzzaman, 1996, Baldwin and Lin, 2001, Baldwin, 1997, Gellatly, 1999), additional research is required to determine how the costs of training affect firms' decisions to innovate and adopt new technologies. It would also be valuable to identify the type of industry where skill requirements are more likely to slow down the adoption of new technologies and whether promoting training would increase the speed of technology adoption. As well, it may be useful to improve our understanding of how innovation strategies vary across industry sectors, and how different innovation strategies are reflected in human resource practices and training activities. Finally, examining in more detail the complementarity between skills and technologies is likely to provide some indication of the extent to which training differences between Canada and the US are the result of differences in the adoption of new technologies.

3.3 Training, workplace practices and organizational change

What we know

Several recent studies have found that the implementation of particular business strategies and practices, such as investment in information and communications technologies, concurrent engineering, total quality management, just-in-time inventory and so on, have a positive impact on subsequent firm performance, as measured by growth in productivity and/or market share (e.g. Brynjolfsson and Hitt, 1996; Lichtenberg, 1995; Baldwin and Sabourin, 2002; Baldwin, Sabourin and Smith, 2003). However, the successful implementation of these so-called high performance workplace practices typically requires new skills. Hence, the gains from implementing organizational changes are usually greater when combined with human resource management strategies, including investment in training.

Breshahan, Brynjolfsson and Hitt (2002) provide evidence that the complementarity between technology use and changes in organizational practices increases the demand for skilled labour. The complementarity between technology use, organizational change and skills is also shown in Gera and Gu (2003). Again, coordination problems between firms' decisions to implement organizational changes and workers' decisions to acquire new skills are likely to induce firms to provide training.

Knowledge gaps

The design of effective policies to promote training requires a better understanding of the complementarities between skills, workplace practices and organizational changes. Various

issues may be worth exploring, for example: To what extent is the adoption of high performance workplace practices associated with investment in skills across different industries and across firms of different sizes? Is there any evidence that Canadian firms train less because of a lower rate of adoption of organizational innovations, relative to other countries? Is capital deepening technical change leading to more organizational change within firms and higher investment in worker skills? How is training activity related to the use of various human resources management practices within organizations?

3.4 Training and the firm's life-cycle

What we know

The typical life-cycle of firms involves various stages: entry, research and innovation, investment, growth, decline, and possibly exit. For several reasons, we should expect training activities to be related to firms' life-cycle. For example, new firms might need to train their newly hired workers, growing firms might need to engaged in a more diversified set of activities which may require additional knowledge and skills, mature firms might find it easier to finance their training activities since they can more easily use retained earnings for that purpose, declining firms might face reduced incentives to invest in training if they are not likely to remain in business long enough to reap the benefits, etc.

There is mixed empirical evidence on the relation between training and the growth of firms. From the Survey of Operating and Financing Practices of Entrants, Baldwin (2000) reports that entrants that place greater emphasis on employee training are more likely to succeed. Training not only complements the innovation and technological strategy of firms, it also has an independent positive effect on the growth prospects of new firms. As well, from the Survey of Growing Small and Medium-Sized Enterprises, skilled labour is found to be one of the most important factors behind firm growth (Baldwin, Chandler, Le and Papailiadis, 1994).

However, differences in training effort between more and less successful firms vary across industries. For all industries taken together, Baldwin (1999) finds that there are no significant differences in the training participation rate of employees and in training expenditures per employee between more and less successful firms, where firm performance is defined by the growth in market share, and the productivity and profitability of the firm relative to that of other firms in the same industry. On the other hand, the more successful firms in business services, retailing, wholesaling and accommodation and food services are found to give more importance to employee training.

Knowledge gaps

Linking firms' training activities not only to their growth profile, but also to other life-cycle characteristics, such as their market share and their position relative to competitors, would be a useful area of research. It would likely improve our understanding of firms' training decisions in the context of dynamic industries that experience innovation, leadership changes, demand shocks, etc. It would also improve our understanding of the differences in training effort

observed across firms of varying sizes and across industries that differ in the pace of innovation, the persistence of industry leadership, the level of concentration and competition, and so on.

3.5 Training and the state of excess demand for skills in the labour market

What we know

Firms that need specific skills in their production activities can either buy these skills in the labour market or produce them by training their current employees. While it may be cheaper and faster to fulfil skill requirements by hiring new workers when the required skills are abundantly available in the labour market, searching costs may be too great if those skills are relatively scarce. In contrast to other goods and services, the supply of particular skills may adjust slowly to changes in demand. There may be slow adjustment if, for example, labour market participants are liquidity-constrained or time-constrained. In this case, new skill requirements are more likely to be fulfilled with firm training, rather than skill investment by individuals and labour reallocation. Hence, we should expect levels of training investment by firms to be related to external labour market conditions, including both the overall tightness of the labour market and the availability of specific skills.

Knowledge gaps

It would likely be useful for policy purposes to explore further how external labour market conditions affect the incentives of firms to train. Are firms training in response to skill shortages in the labour market? Is there any relationship between firms' training activities and business cycles, or the overall tightness of the labour market? Has the poor average economic performance of Canada relative to the U.S. been a factor in observed training outcomes? Are high searching costs for particular skills leading firms to train their current employees?

3.6 Policies affecting training

What we know

There is a wide range of policies that can affect firms' incentives to invest in training: subsidies and corporate tax deductions for training expenditures, minimum level of training expenditures specified by legislation, labour market regulation, etc. But, very little empirical evidence is available about the impact of actual policies on firms' training investment. If firms' decisions to train are closely linked to their decisions to innovate or adopt new technologies, the cost of training may only be one among various factors driving training investments. In this case, policies that lower the cost of training may have a relatively limited impact on firms' training investments. On the other hand, if training is best viewed as a continuous investment decision, largely independent of other activities, then policies that affect incentives at the margin are more likely to induce higher training.

Knowledge gaps

The impact of policy incentives on firms' decisions to train needs to be better documented and understood. How are specific tax measures and training subsidies affecting firms' incentives to train? Are the training expenditures of particular groups of firms more sensitive to policy measures? Are tax penalties for low training investment (such as the one in Quebec) inducing higher levels of productive training expenditures?

4. Public policies and employer-supported training

This section discusses policies for training from a normative perspective. We begin with a discussion of the market failures that potentially distort firms' decisions to invest in training. We then discuss policy intervention with the objective of identifying the main considerations that need to be taken into account in designing policy measures to promote training. We first consider efficiency-enhancing policies, i.e. policies to address market failures in training. We consider only potential policy measures to correct for the market failures and externalities directly associated with training decisions. Therefore, we do not consider general labour market imperfections -- some of which were discussed in Section 3 -- that may also affect training decisions. Policies specifically targeted at those are beyond the scope of this project. Finally, we briefly explore equity-enhancing policies.

4.1 Market failures and firms' training decisions

What we know

Credit market imperfections are often seen as one of the main source of inefficiency in training investments, particularly those of workers and small firms. Borrowing to invest in training can be difficult given that human capital can hardly be used as collateral on loans. Since workers may be liquidity constrained, they may be unable to invest in their own training even if the expected rate of return is very high. Likewise, because it may be difficult for small and young firms to use retained earnings to finance investments, credit market failures may prevent them from optimally investing in the skills of their employees.

Training externalities due to labour turnover are another potential source of distortion in training decisions, provided that firms invest in the general skills of their workers. However, there is little empirical evidence available to assess the importance of such externalities. One exception is the study of Lowenstein and Spletzer (1997), based on the US National Longitudinal Survey of Youth, who found that uncertainty about the future mobility of employees tends to delay employer investment in formal training.

In addition to credit market failures and poaching externalities, sub-optimal training can also occur because of incomplete contracts between firms and workers, giving rise to a form of hold-up problem. As argued by Malcomson (1997), investment in training, either by the employer or the employee, creates a rent associated with the worker-firm match, which implies a

gap between the reservation wage of the worker and the maximum wage that the firm is willing to pay. After training has taken place, the employer and the employee bargain over the wage and both capture a share of the surplus, even if the training is completely specific. Since both anticipate the bargaining outcome and the fact that they will be unable to appropriate the entire return from an investment in training, they both under-invest relative to the optimum.

Various forms of information failures can also result in sub-optimal training, particularly in smaller firms. For example, imperfect information about the returns to training, combined with risk aversion by employers, might create some reluctance among employers to invest in skills (Betcherman, Leckie and McMullen, 1998). Risk-adverse firms are likely to undervalue human capital investments and favour investment options for which more information is available about expected rates of return, such as investments in physical capital. Employers might also have limited information about the type of training needed to meet the skills requirements of the job, they might lack information about potential training providers and opportunities, the quality of training, etc.

As emphasized in the growth literature, investment in human capital may be sub-optimal because of non-decreasing social returns in the accumulation of human capital (e.g. Lucas, 1988).[7] Increasing social returns may arise if the skills of an individual generate external benefits by increasing the productivity of other factors of production, in particular that of other workers. However, while human capital externalities would generally lead individuals to under-invest in their own skills relative to the social optimum, they would only result in sub-optimal training by firms if the benefits of skills spill over to workers in other firms. The human capital externalities that arise between co-workers, which are likely to be the most significant ones, would be internalized in firms training decisions. In any case, human capital externalities do provide a rationale for encouraging investment in skills, although a much stronger one for investment by individual than investment by firms.

Knowledge gaps

There is little evidence about the empirical importance of the market failures and externalities identified above. Therefore, expanding our knowledge of their impact on the training decisions of Canadian firms would be highly valuable for policy purposes. In fact, the rationale for policy intervention ultimately depends on whether these distortions in firms training decisions are significant. In order to assess the size of these distortions, a number of issues may be examined.

For example, the relationship between training participation and subsequent worker mobility and wages may be indicative of whether training externalities due to labour turnover are important. For instance, observing high turnover rates among training participants and increased wages for trained workers that moved to new firms, might suggest that this type of externality is important for firms' training decisions.

[7] See Bassanini and Scarpetta (2001) for recent empirical evidence of non-decreasing returns to broad capital (human and physical) across OECD countries over the 1971-1998 period.

If information failures are important, perhaps we would observe high returns on the training investments that are undertaken, since it may only be worthwhile to incur the cost of acquiring information about training needs, training opportunities, providers, and so on, if the expected benefits of training are very high.[8]

Finally, looking at how training investments vary with the development stages of firms may provide some evidence about the importance of credit market failures. Young firms are often liquidity-constrained and may have few assets to use as collateral. On the other hand, they typically need to hire new workers, invest in innovation and adopt new technologies, all of which usually require substantial training.

4.2 Efficiency-enhancing policies

What we know

The design of training policy is likely to be fairly complex given that the importance of distortions in training decisions vary across groups of firms and workers, and that some of the information failures identified above may equally limit the ability of governments to induce optimal training. The objective of efficiency-enhancing policies in this context is to improve the allocation of resources to training, taking into account the trade-offs between the deadweight loss of existing market failures and the distortions induced by policy measures themselves, as well as the public funds required to finance the costs of policy intervention. This sub-section provides a discussion of the trade-offs involved, by focusing on the following general characteristics of policy measures: i) tax incentives versus subsidies; ii) broad-based versus targeted measures; iii) public provision versus market-based intervention; iv) measures focusing on employers' incentives versus employees' incentives.

Tax incentives versus subsidies

Train-or-pay schemes require firms to pay a tax equal to the difference between some minimum level of expenditure on training and the amount actually spent, typically as a share of the firm's payroll. For firms that would otherwise spend less than the minimum amount, the scheme is equivalent to a payroll tax combined with a 100 percent subsidy on training expenditures up to the specified minimum level. The marginal incentives to train of firms that would otherwise spend more than the minimum level are unchanged. Train-or-pay schemes have the advantage of increasing training activity at no direct cost in terms of public funds. However, such a policy may only be efficiency-enhancing if the firms that spend the smallest share of their payroll on training are also the ones that tend to under-invest relative to the optimum. But, it is not clear that firms with low training needs are more subject to market failures. Hence, it seems unlikely that

[8] Rates of returns to training are usually found to be quite high and substantially above the normal returns on physical capital investments (Mincer, 1989; Frazis and Loewenstein, 1999). However, most empirical analysis of the returns to training simply measure the increase in wages or productivity without taking costs into account (Machin and Vignoles, 2001). Recent surveys, such as the WES, provide longitudinal and employer-employee linked data on the costs of training to employers, firm profitability and worker wages, among other things, which may facilitate future research on this issue.

such a policy would allocate training incentives efficiently, and may be more useful at addressing equity objectives.

Tax deductions for training expenditures may be more effective at increasing the marginal incentives of firms to invest in training. For example, allowing the deduction of more than 100 percent of training expenditures from corporate income lowers the effective cost of training. However, it favours firms with tax liabilities, even if tax deductions can be carried forward. This appears to be an important drawback, given that young firms are usually the ones with no tax liabilities, but also those that typically need to hire and train new workers and that tend to be liquidity constrained, and therefore more subject to credit market failures. Young firms may also face larger information problems. So, tax deductions for training expenditures may not be very appropriate if the rationale for policy intervention is to address credit market failures and information failures.

Subsidies for training expenditures would avoid the undesirable selection effects of train-or-pay schemes and tax deductions. However, subsidy policies are probably more costly to administer than tax deductions and probably more burdensome for firms.

Broad-based versus targeted measures

Because the different forms of market failures are likely to affect various groups of firms and workers differently, it may be desirable to target measures according to specific characteristics of employers and employees. However, targeting programs to workers with low training incidence, such as low-educated, blue-collar and older workers, may lead to adverse substitution effects. To take advantage of program benefits, employers may be induced to provide training to these groups of workers, rather than workers with the highest expected return. On the other hand, targeting programs to specific groups of firms, such as small firms, may be desirable if it prevents giving training incentives to firms that would tend to provide high levels of training anyway. Hence, targeting programs according to firm characteristics, but applying the program measures to all types of worker within these firms is likely to minimize the deadweight cost of policy intervention.

Public provision versus market-based intervention

Rather than providing training incentives to firms and workers, the government may provide training directly to particular groups of workers. However, public training programs are likely to lack information about the specific training needs of workers and they might fail to take advantage of the complementarity between training and production. Therefore, public provision appears inappropriate if information failures are the source of under-investment, since the government is not likely to be better informed than firms about the type of training needed by workers and their ability to assimilate the training received. In fact, the empirical literature on the evaluation of public training programs generally finds that such programs are not very effective at improving the skills of economically disadvantaged workers. Evaluations typically find

modest positive effects, at best, on the labour market outcomes of low-skilled and low-income individuals.[9]

On the other hand, if poaching externalities are important, the type of training provided may be distorted in the sense that firms will tend to over-provide specific training relative to general training. In this case, increasing firms' incentives to train will not be very beneficial, in contrast to public training programs which are likely to focus on the general skills of workers. Alternatively, pay-back clauses may be an effective market-based policy to deal with poaching externalities. Pay-back clauses stipulate that workers leaving a firm within a certain period after receiving training must reimburse some of the training costs, which limits the ability of other firms to attract trained workers and increases the firm's expected benefits of providing general training.

Firms incentives versus employees incentives

Although our main focus is on firm investment in human capital, if employee demand for training is an important determinant of training outcomes, effective policies to promote training may need to focus on employees' incentives to train as well as the incentives of firms to provide training. Kapsalis (1996) finds, using data from the 1994 AETS, that employees who wish to engage in training have a higher probability of receiving employer-sponsored training. The IALS also shows that groups with a high incidence of employer-sponsored training typically have a high incidence of own-supported training as well (Kapsalis, 1997), which suggests that employee perceptions about training has an impact on the likelihood of receiving employer support. The fact that unionized workers receive more training seems consistent with the view that equilibrium training is partly determined by the demand side, given that employee demands tend to be better transmitted and reflected in work agreements when they are expressed through unions.

If the demand of employees is an important determinant of training, implementing a training certification system may be an effective policy to promote training. The certification of training can facilitate contracting between workers and firms by reducing the externalities that arise when both can invest in training non-cooperatively and then bargain over the wage rate in the context of a non-competitive labour market (Acemoglu and Pischke, 1998). On the other hand, if training is only driven by firms' incentives to invest in human capital, certification may discourage the support of firms for training, since it removes the uncertainty about the value of training from the perspective of competing firms, thereby making labour turnover more likely. However, Acemoglu and Pischke (1999c) show that if the worker's effort in training is unobservable, certification may be required to limit the firms' market power and insure that workers capture some of the return from training. Certification balances the power between workers and firms, and therefore provides incentives to workers to exert some effort in training.

Therefore, implementing a certification system may be an effective policy to promote training if either the demand of employees is an important determinant of firm support for

[9] See Friedlander, Greenberg and Robins (1997) and Lalonde (1995) for reviews of the literature on the evaluation of government training programs in the US.

training or if the trainee's effort level is difficult to observe, or cannot be verified and therefore specified in contracts. However, before prescribing the implementation of a training certification system, more information is needed about the associated costs. Such a system would require the establishment of standards, evaluation authorities and procedures, among other things, which may increase significantly the overall costs of training.

Other policy instruments available to increase employee demand for training include individual learning accounts and training leave schemes. Individual learning accounts are savings accounts in which workers and the government or the employer contributes for the purpose of financing future training activities. Training leave schemes can facilitate access to training by providing employees with the right to return to their jobs after leaving while following a training program, or by reimbursing part of forgone wages during the training period. Although individual learning accounts and training leave schemes have been used in a number of countries, little empirical evidence about their effectiveness is available.

Knowledge gaps

Given the potential market failures in training decisions and the general considerations regarding policy design and objectives discussed above, future research is required to expand our knowledge about which instruments are more appropriate and about how policies for training should be designed, both from theoretical and practical perspectives. At the theoretical level, we need to determine which type of policies are more likely to achieve particular objectives, and whether that will depend on various factors such as labour market structure and institutions, rate of technical change, product market competition, etc. From a practical perspective, future research should document and analyse experiences with different types of policies, both in Canada and abroad, to determine whether they achieved their objectives and to learn more about their costs and benefits, implementation problems, and so on.

4.3 Equity-enhancing policies

What we know

There is substantial evidence showing that more educated and skilled workers received more employer-sponsored training,[10] which may imply that the training practices of firms tend to widen skill gaps.[11] Thus, the distribution of firm support for training raises equity concerns and possibly justifies policy intervention over and above the rationales that arise from market failures and externalities. Given the critical impact of skills on labour market outcomes, it may be desirable to implement policies that will offer a more equal access to training opportunities, and in turn, maintain the employability of low-skilled individuals despite the rapidly changing skill requirements of the labour market induced by technical change.

---

[10] For Canadian evidence, see for example Jennings (1996), Léonard (2001) and Turcotte, Léonard and Montmarquette (2003).

[11] However, Bartel and Sicherman (1995) provide empirical evidence that more rapid technical change leads firms to provide more training to production workers, which suggest that the adoption of new technologies and the associated skill requirements might contribute to reduce training gaps between more and less skilled workers.

However, although there may be a clear motivation for improving the labour market outcomes of particular groups of workers, it is not as clear that the promotion of training is the most cost-effective strategy. As pointed out by Heckman and Lochner (1999), using training to raise the earnings of low-skilled individuals may be very costly, especially for older workers who may not assimilate as well the training received and who have fewer remaining working years to benefits from the skills acquired.

Knowledge gaps

Before any policy conclusion can be reached, further research is required to establish whether there is an equity rationale for the promotion of training among particular groups of workers, and to identify appropriate policy instruments.

5. Conclusion

In order to assist policy makers in the area of human capital, we need to improve our understanding of training in Canadian firms, from both positive and normative perspectives. Identifying the main drivers of firms' training can be useful at assessing Canada's relative performance in this area, and at predicting the likely impact of different policies on training decisions. But, in order to establish a solid rationale for policy intervention and determine the form of appropriate policies, it is useful to assess the social optimality of training decisions. Our selective review of issues has been organized around these key considerations for policy-making. Hence, important areas for future research are the following.

First, identifying the main covariates of employer-supported training and the proximate factors behind Canada's performance in this area relative to that of other developed countries, in particular the United-States, would provide useful information about the distribution of training resources and may be indicative of whether our levels of training investment are adequate. Although there exist considerable literature on the covariates of training, specific research avenues may still improve our understanding of differences in training activity observed across different groups of workers, different groups of firms, and ultimately between Canada and other countries. Some of these research avenues may include a more in-depth analysis of informal on-the-job training, as well as giving more attention to the intensity of training (possibly measured by hours of training or firms' training expenditures), as opposed to training participation. Finally, research could make use of recently available employer-employee linked data sets.

Second, we need to improve our understanding of firms' decisions to invest in skills. Empirical evidence seems to show that firms support a substantial part of the costs of training, even if it is general in nature, and also capture most of the benefits in the form of higher productivity. Such evidence suggests that firms' training decisions are likely to be better understood in the context of imperfect labour markets. Consequently, investigating how the structure of labour markets, including wage structures and labour markets institutions, affects the incentives of firms to provide training is an important area of future research. Although the distribution of training costs and benefits is crucial for firms' incentives to train, their training

decisions may also be driven by the complementarity between skills and technological or organizational change, by their stage of development, by the state of overall conditions in the labour market and by various policies. These specific drivers of firm training decisions seem to deserve further attention as well.

Third, we need to determine whether firms' training decisions are distorted by various market failures and externalities. There are numerous candidates, but their empirical importance is largely unknown. This appears to be an important knowledge gap, since prescribing policy intervention without clear evidence of distortions in firms' training decisions may be hazardous. To the extent that policy intervention is justified, there is also a need to learn more about the form of appropriate policies. Various instruments are available, but their usefulness is likely to depend on the policy objectives, including the particular distortions that are targeted.

Addressing all the research gaps that have been identified would likely require more resources than those available. Therefore, priorities will have to be established. In doing so, key considerations should include policy relevance and data availability. And, although effective policy making needs to be grounded on empirical evidence, some complementary theoretical research should not be excluded. For example, theory work may be useful at generating new testable hypothesis about firms' training decisions or at predicting the impact of particular policies on training outcomes.

References

Acemoglu, D. (1997), 'Training and Innovation in an Imperfect Labor Market', *Review of Economic Studies* 64: 445-464.

Acemoglu, D. and J.S Pischke (1998), 'Why Do Firms Train? Theory and Evidence', *Quarterly Journal of Economics* 113: 79-119.

Acemoglu, D. and J.S Pischke (1999a), 'Beyond Becker: Training in Imperfect Labour Markets', *Economic Journal*, F112-142.

Acemoglu, D. and J.S Pischke (1999b), 'Minimum Wages and On-the-Job Training', *NBER Working Paper* 7184.

Acemoglu, D. and J.S Pischke (1999c), 'Certification of Training and Training Outcomes', MIT.

Autor, D. (2001), 'Why Do Temporary Help Firms Provide Free General Skills Training?', *Quarterly Journal of Economics* 116: 1409-1448.

Baldwin, J. (1997), 'The Importance of Research and Development for Innovation in Small and Large Canadian Manufacturing Firms', Research Paper No. 107, Analytical Studies Branch, Statistics Canada.

Baldwin, J. (1999), 'Innovation, Training and Success', Research Paper No. 137, Analytical Studies Branch, Statistics Canada.

Baldwin, J. (2000), 'Innovation and Training in New Firms', Research Paper No. 123, Analytical Studies Branch, Statistics Canada.

Baldwin, J., W. Chandler, C. Le and T. Papailiadis (1994), 'Strategies for Success: A Profile of Growing Small and Medium-Sized Enterprises in Canada', Catalogue 61-523-RPE, Ottawa: Statistics Canada.

Baldwin, J. and M. Da Pont (1996), 'Innovation in Canadian Manufacturing Enterprises', Catalogue 88-513-XPB, Ottawa: Statistics Canada.

Baldwin, J., G. Gellatly, J. Johnson and V. Peters (1998), 'Innovation in Dynamic Service Industries', Catalogue 88-516-XPB, Ottawa: Statistics Canada.

Baldwin, J. and J. Johnson (1996), 'Human Capital Development and Innovation: A Sectoral Analysis', in The Implications of Knowledge-Based Growth for Micro-Economic Policies, Edited by P. Howitt, University of Calgary Press.

Baldwin, J. and Z. Lin (2001), 'Impediments to Advanced Technology Adoption for Canadian Manufacturers', Doc. #173, Analytical Studies Branch, Statistics Canada.

Baldwin, J., D. Sabourin (2002), 'Advanced Technology Use and Firm Performance in Canadian Manufacturing in the 1990s', *Industrial and Corporate Change* 11 (4): 761-789.

Baldwin, J., D. Sabourin and M. Rafiquzzaman (1996), 'Benefits and Problems Associated with Technology Adoption in Canadian Manufacturing', Catalogue 88-514E, Ottawa: Statistics Canada.

Baldwin, J., D. Sabourin and D. Smith (2003), 'Impact of Advanced Technology Use on Firm Performance in the Canadian Food Processing Sector', *Economic Analysis Research Paper Series*, No. 12, Analytical Studies Branch, Statistics Canada.

Barron, J., M. Berger and D. Black (1999), 'Do Workers Pay for On-the-Job Training?', *Journal of Human Resources* 34: 235-252.

Barron, J., D. Black and M. Lowenstein (1989), 'Job Matching and On-the-Job Training', *Journal of Labor Economics*, 1-19.

Bassanini, A. and S. Scarpetta (2001), 'Does Human Capital Matter for Growth in OECD Countries? Evidence from Pooled Mean-Group Estimates', *OECD working paper* no. 282.

Becker, G. (1964), 'Human Capital: A Theoretical Analysis with Special Reference to Education', Columbia University Press, New York.

Betcherman, G., N. Leckie and K. McMullen (1998), 'Barriers to Employer-Sponsored Training in Canada', CPRN working paper.

Bishop, J. (1991), 'On the Job Training of New Hires', In *Market Failures in Training? New Economic Analysis and Evidence on Training of Adult Employees*, ed. D. Stern and J. Rizen, New-York: Springer-Verlag.

Booth, A. and M. Bryan (2002), 'Who Pays for General Training? New Evidence for British Men and Women', *IZA Discussion Paper* No. 486.

Breshahan, T. and L. Hitt (1996), 'Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending', *Management Science*, 42 (4): 541-558.

Breshahan, T., E. Brynjolfsson and L. Hitt (2002), 'Information Technology, Workplace Organization, and the Demand for Skilled Labor: Firm-Level Evidence', *Quarterly Journal of Economics*, 339-376.

Brunello, G. (2002), 'Is Training more Frequent when Wage Compression is Higher? Evidence from 11 European Countries', *CESifo Working Paper No. 637.*

Conseil de la science et de la technologie (2003), 'L'innovation dans les services', Gouvernement du Québec.

Frazis, H. and M. Loewenstein (1999), 'Reexamining the Returns to Training: Functional Form, Magnitude, and Interpretation', US Bureau of Labour Statistics, *Working Paper 325*.

Friedlander, D., D. Greenberg and P. Robins (1997), 'Evaluating Government Training Programs for the Economically Disadvantaged', *Journal of Economic Literature* 35: 1809-1855.

Gellatly, G. (1999), 'Differences in Innovator and Non-Innovator Profiles: Small Establishments in the Business Services, Analytical Studies Branch, Statistics Canada.

Gera, S., W. Gu and J. Cawthray (2002), 'The Effect of Organizational Innovation and Information Technology on Productivity: Firm-Level Evidence', Industry Canada.

Heckman, J. and L. Lochner (1999), 'Rethinking Education and Training Policy: Understanding the Sources of Skill Formation in a Modern Economy'.

Jennings, P. (1996), 'Employer-Sponsored Training in Canada: Evidence from the 1994 Adult Education and Training Survey', Applied Research Branch, HRDC, Working Paper W-96-4E.

Kapsalis, C. (1996), 'Determinants of Employer-Sponsored Training: An Analysis of the1994 Adult Education and Training Survey', Applied Research Branch, HRDC, Research Paper R-96-14E.

Kapsalis, C. (1997), 'Employee Training: An International Perspective', Catalogue 89-552-MPE, No. 2, Ottawa: Statistics Canada.

Katz, E. and A. Ziderman (1990), 'Investment in General Training: The Role of Information and Labour Mobility', *Economic Journal* 100: 1147-1158.

Lalonde, R. (1995), 'The Promise of Public Sector-Sponsored Training Programs', *Journal of Economic Perspectives* 9: 149-168.

Léonard, A. (2001), 'Why Did the Participation Rate in Job-Related Training Decline During the 1990s in Canada?', Applied Research Branch, HRDC, Research Paper R-01-9-4E.

Lichtenberg, F. (1995), 'The Output Contribution of Computer Equipment and Personal: A Firm-Level Analysis', *Economics of Information and New Technology*, 3: 212-223.

Loewenstein, M. and J. Spletzer (1997), 'Delayed Formal On-the-Job Training', *Industrial Labour Relations Review* 51: 82-99.

Loewenstein, M. and J. Spletzer (1998), 'Dividing the Costs and Returns to General Training', *Journal of Labor Economics* 16: 142-171.

Lucas, R. (1988), 'On the Mechanics of Economic Development', *Journal of Monetary Economics* 22: 3-42.

Lynch, L. (1992), 'Private Sector Training and the Earnings of Young Workers', *American Economic Review* 82: 299-312.

Machin, S. and A. Vignoles (2001), 'The Economic Benefits of Training to the Individual, the Firm and the Economy: The Key Issues', London School of Economics.

Mincer, J. (1989), 'Human Capital and the Labor Market: A Review of Current Research', *Educational Researcher* 18: 27-34.

Neal, D. (1995), 'Industry-Specific Human Capital: Evidence from Displaced Workers', *Journal of Labor Economics* 13: 653-677.

OECD (1999), "Training of Adult Workers in OECD Countries: Measurement and Analysis", 133-75, in *1999 OECD Employment Outlook*, Paris: Organisation for Economic Co-Operation and Development.

Rao, S, J. Tang and W. Wang (2002), 'The Importance of Skills for Innovation and Productivity', *International Productivity Monitor*, Centre for the Study of Living Standards, no 4, 15-26.

Turcotte, J., A. Léonard and C. Montmarquette (2003), 'New Evidence on the Determinants of Training in Canadian Business Locations', Statistics Canada and HRDC, *The Evolving Workplace Series*, catalogue no. 71-584-MIE.

Veum, J. (1995), 'Training, Wages, and the Human Capital Model', US Bureau of Labour Statistics, Working Paper 262.

Wannell, T. and J. Ali (2002), 'Working Smarter: The Skill Bias of Computer Technologies', Catalogue 71-587-XIE, No. 3, Ottawa: Statistics Canada.